Public Law 112-149 Continued Monitoring of Runit Island: STRATEGIC ACTIONS, KEY FINDINGS AND FUTURE WORK

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DOI Briefing Note

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STRATEGIC ACTIONS 2013-current

- **Together with external consulting experts, successfully completed an initial engineering and visual survey of the concrete cap covering the waste containment structure** (Hamilton 2013, A Visual Description of the Concrete Exterior of the Cactus Crater Containment Structure, LLNL-TR-648143 – see attached) [2013 Year 1 DOI incremental annual funding with supplemental funds under the DOE regular Marshall Islands Program]
- **Re-established and conducted initial pump tests on National Academy of Sciences (NAS) boreholes cited on and around the containment structure** [DOE programmatic funds]
- **Collected initial groundwater samples from on and off the containment structure for measurement of radionuclides and other water quality parameters** [DOE programmatic funds]
- **Prepared informational RFP to conduct a drilling operation to establish a series of sampling boreholes to collect groundwaters samples at different depths within the waste pile** (Hamilton et al. 2017, Drilling, sampling and installation of groundwater monitoring wells on Runit Island, Enewetak Atoll, Republic of the Marshall Islands, Request for Proposal (RFP) Background Documentation, LLNL-MI-733219, see attached] [DOE programmatic funds]

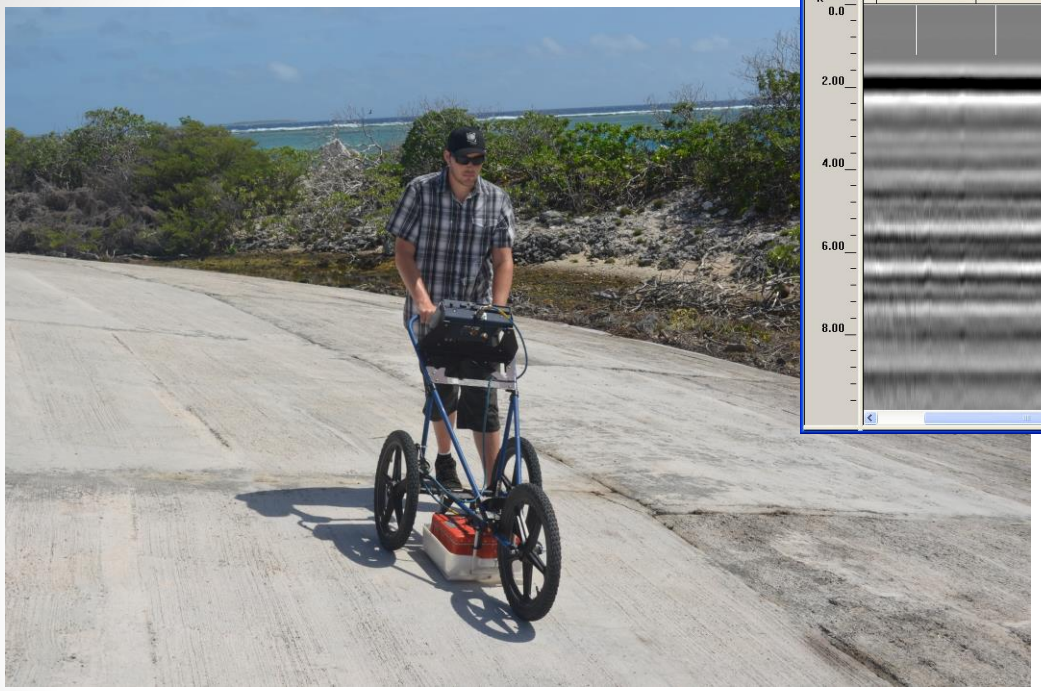
STRATEGIC ACTIONS 2013-current

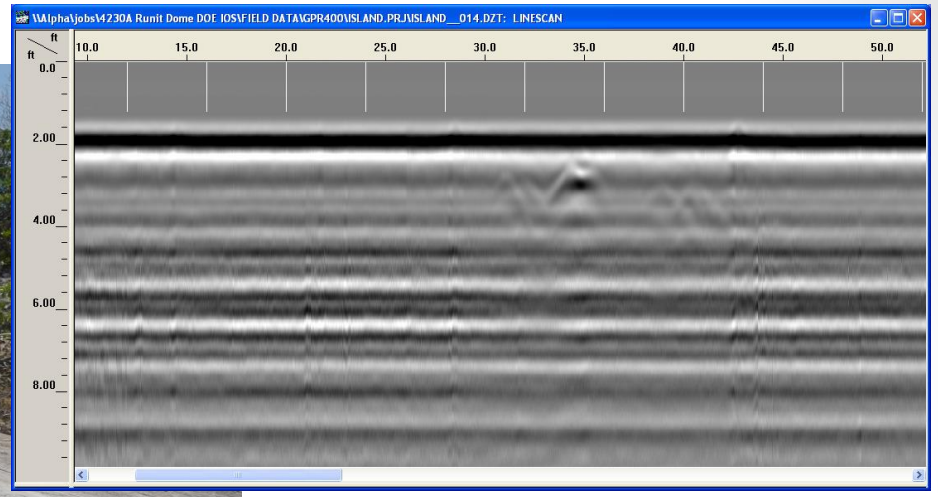
- **Initiated a vegetation eradication program to reduce impacts of rooting vines on possible spalling of concrete** [DOE programmatic funds]
- **Together with consulting experts, collected a series of concrete cores from the containment structure for analysis for physical, petrographic and chemical testing** [DOE programmatic funds]
- **Established a network of pressure transducer water monitoring sensors in the groundwater beneath the containment structure as well as in the lagoon and ocean to evaluate the connectivity between surrounding water bodies …, based on the rate of change in the height of water inside the structure relative to tidal flows and other forcing events such as storm surge**] [DOE programmatic funds]
- **Developed a 3-D animation outlining requirements for establishing a drilling project to develop water sampling wells inside the containment structure as a basis for developing a scientifically defensible and credible long-term groundwater monitoring and meet the intent of the P.L.** (Hamilton et al., 2017 RunitDome Drilling [play from last page of this presentation] along with numerous other presentation tools and Power Point slides) [DOE programmatic funds]
- **Purchased a Faste Drilling Rig and staged in Hawaii in preparation for the drilling phase of the project** [purchased 2014 Year 2 DOI incremental annual funding)

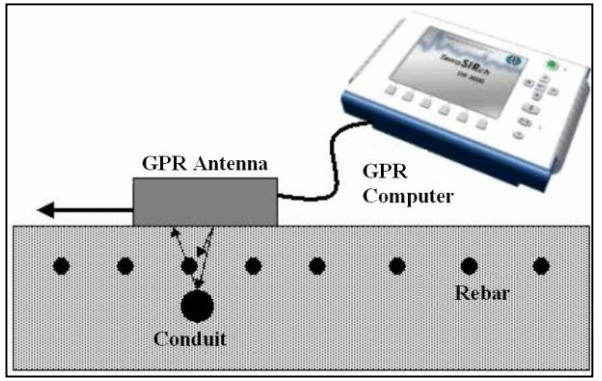
STRATEGIC ACTIONS 2013-current

- **Conducted initial sets of analyses of fallout radioactivity contained in groundwater samples collected from within the waste pile compared with levels observed in Enewetak lagoon and the open ocean** (summary findings published as a Fact Sheet (see attached), peer review publication pending) [DOE programmatic funds]
- **Together with consulting experts, initiated a concrete cap maintenance program for repair of concrete spalls and cracks in the concrete façade covering the containment structure** [DOE programmatic funds]
- **Conducted a follow-up photographic drone survey of the containment structure** (October 2018, report pending) [DOE programmatic funds]

Engineering Survey Measurements (Olsen Engineering, Inc.)

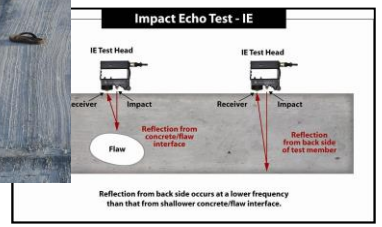






(GPR)

[Nondestructive testing of the integrity of the concrete to look for voids (air pockets) and other reflective anomalies down through the waste pile]



Supplemental

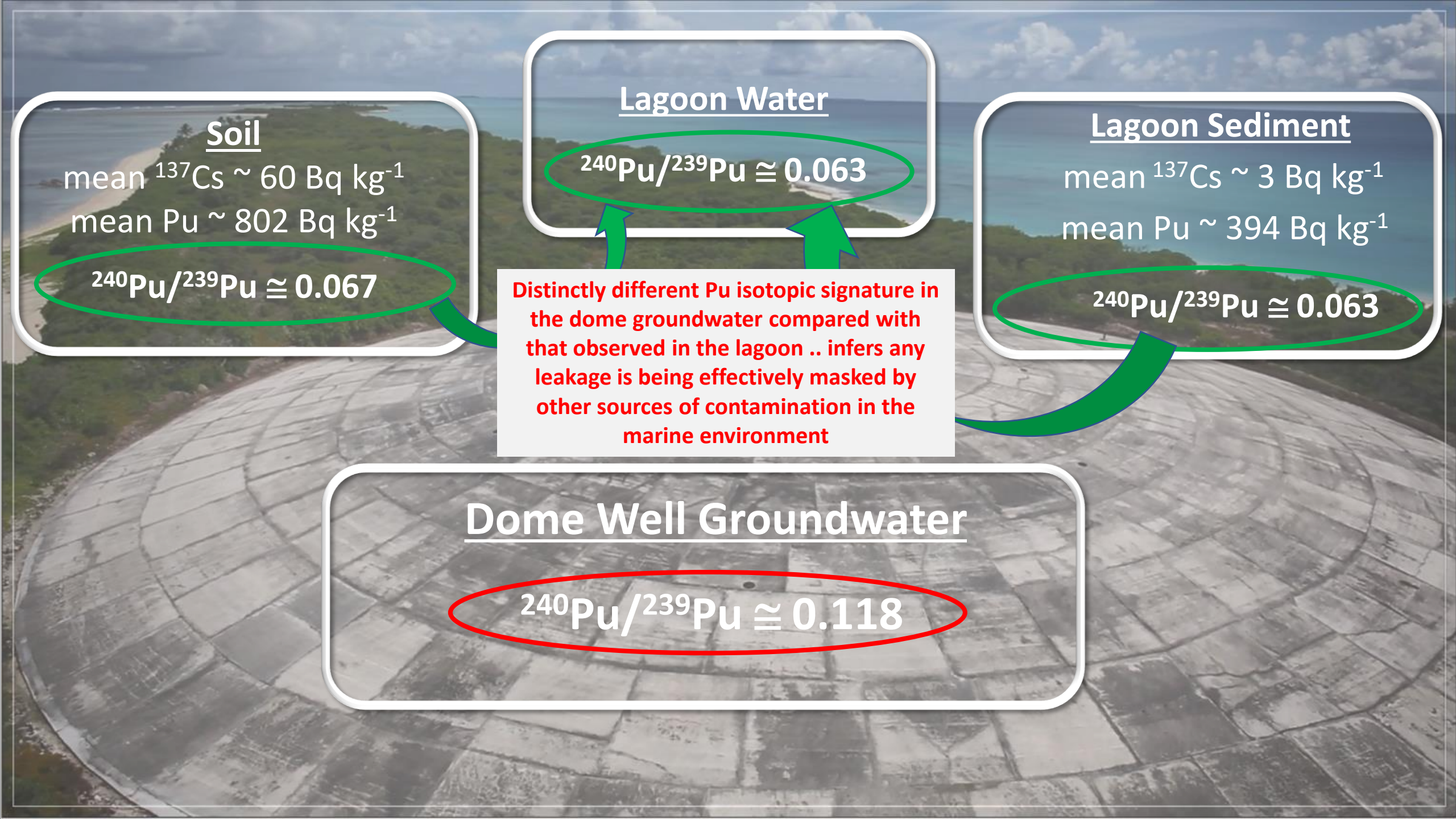
[Accurate measure of the thickness of the concrete cap]

BEFORE

AFTER

Initial Measurement of Fallout Radioactivity in a *Runit Dome Borehole*

Radionuclide	Units	Concentration	Groundwater		Lagoon Water	
			Surface	Ocean	Surface	Ocean
^{90}Sr	Bq L^{-1}	6.30±0.08	6000-9000		~1-3	
^{137}Cs	Bq L^{-1}	2.15±0.04	1000-2000		~1-3	
^{129}I	μBq L^{-1}	63±3	3000-4000		~1-2	
$^{239+240}Pu$	mBq L^{-1}	0.73±0.02	200		~100	


Soil
mean ^{137}Cs ~ 60 Bq kg^{-1}
mean Pu ~ 802 Bq kg^{-1}
$^{240}Pu/^{239}Pu \cong 0.067$
Lagoon Water
$^{240}Pu/^{239}Pu \cong 0.063$
Lagoon Sediment
mean ^{137}Cs ~ 3 Bq kg^{-1}
mean Pu ~ 394 Bq kg^{-1}
$^{240}Pu/^{239}Pu \cong 0.063$
Distinctly different Pu isotopic signature in the dome groundwater compared with that observed in the lagoon .. infers any leakage is being effectively masked by other sources of contamination in the marine environment
Dome Well Groundwater
$^{240}Pu/^{239}Pu \cong 0.118$

General Findings

- The concrete façade or cap covering the containment structure remains structural sound .., existing cracks and spalls in the concrete are not affecting the structural integrity of the containment structure
- Ground Penetrating Radar (GPR) analyses indicate that the concrete cap contains a small faction of locations (<1%) that are likely to be poorly supported or voided
- The containment structure remains vulnerable to leakage and the sustained impacts of storm surge and sea level rise
- Surface groundwater samples collected from inside the containment structure contain relatively high concentrations of fallout radionuclides (1000 to 6000 times higher) compared with that observed in the open ocean
- There is clear evidence of direct communication of the groundwater inside the containment structure with the surrounding ocean and lagoon
- Based on isotopic analyses, the local marine radiation environment adjacent to Runit Island is dominated by plutonium mobilization from sedimentary sources to solution, … not from leakage of radioactive from the concrete containment structure
- The groundwater hydrology beneath the containment structure is very complex showing strong salinity, pH and contaminate gradients. This is further exasperated by the heterogeneous nature of the physical placement of waste inside the containment structure

FUTURE WORK

- **As funding becomes available from the DOI, develop a network of groundwater sampling wells located on and off the containment structure[#]**

  These sampling wells will be located in different geologic media and at different depths

- **Conduct an extensive period of sampling and analysis of groundwater and lagoon/ocean water over a period of 18 months covering several seasonal cycles to support ability to model the potential impacts of contaminated water flows reaching outfall points in the lagoon**

- **Provide a scientifically defensible and credible basis for determining the frequency of sampling under a long-term groundwater monitoring program, and ensuring the health and safety of the people of Enewetak**

- **Continue to provide maintenance activities of the concrete façade covering the containment structure to include removal of rooting vines, and repair of concrete spalls and cracks**

[#] **Requires a significant one-time contribution of funds to support the logistical and waste disposal operations needed to establish groundwater sampling wells. This is an obvious fundamental requirement needed to develop a groundwater monitoring program in compliance with the P.L.**

Reference: Drilling, sampling and installation of groundwater monitoring wells on Runit Island, Enewetak Atoll, Republic of the Marshall Islands, Request for Proposal (RFP) Background Documentation, LLNL-MI-733219.